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|-------------------------------------------------------------------------------|-------------|----------------------|---------------------|------------------|
| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
| 09/853,962 | 05/10/2001 | Peter Hey | 004582 | 6593 |
| 32588 | 7590 | 10/14/2003 | EXAMINER | |
| APPLIED MATERIALS, INC. 2881 SCOTT BLVD. M/S 2061 SANTA CLARA, CA 95050 | | | KOPPIKAR, VIVEK D | |
| | | ART UNIT | PAPER NUMBER | |
| | | 1775 | | |

DATE MAILED: 10/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|------------------------------|------------------------|---------------------|--|
| | 09/853,962 | HEY ET AL. | |
| Examiner | Art Unit | | |
| Vivek D Koppikar | 1775 | | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 28 May 2003 .

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-21 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1-21 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on 10 May 2001 is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. ____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) The translation of the foreign language provisional application has been received.

15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) Notice of References Cited (PTO-892) 4) Interview Summary (PTO-413) Paper No(s). _____ .
2) Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) Notice of Informal Patent Application (PTO-152)
3) Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4,7,8. 6) Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 11-21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Step (b) of Claim 11 is indefinite. It is recommended that the limitation of claim 12 be added into claim 11. There is not basis in the specification for any other reduction method other than applying a plating bias to the substrate while immersing the substrate into an electrochemical bath.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

4. Claims 1, 5-6, 8, 10-12 and 16-18 are rejected under 35 U.S.C. 102(a) as being anticipated by WO 99/47731 to Chen.

The examiner takes the position that "high aspect ratio" refers to an aspect ratio of greater than 4:1 and specifically greater than 10:1 as recited in the instant specification (Section [0004]).

Chen is directed towards a method for electrolytically depositing copper on a semiconductor workpiece.

With regard to Claims 1, 6, 8, 10-12 and 18, Chen teaches a method of positioning a substrate covered with a conductive barrier layer (10) (TiN) (Figure 2c and Page 12, Ln. 15-19)

in an electrochemical bath. A second conductive material (15) (a copper layer) is plated onto the barrier layer in an electrochemical bath with the aide of a plating bias (Page 20, Ln. 1-9). Next a further processing step deposits a further amount of copper (18) on the layer (15) (Page 14, Ln. 13-20). This copper layer, which is electrochemically deposited and formed in situ (Figure 3)), fills the trenches and vias in the semiconductor workpiece (Abstract). The current density used during the electroplating step is between around 1 milliamps*min/cm² or 60 mA*sec/cm² (Page 18, Ln. 4-9). Providing the copper layers through electrochemical techniques reduces the voids and non-continuous regions (Page 14, Ln. 2-15).

With regard to Claims 5, 16 and 17, the electrochemical deposition technique used periodic pulses (Page 18, Ln. 8-9).

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-4, 6-15, and 18-21 are rejected under 35 U.S.C. 102(e) as being anticipated by US Patent Number 6,423,636 to Dordi.

Dordi is directed towards a process for improving seed layer productivity for a copper metalization process on a semiconductor wafer.

With regard to Claims 1, 6-8, 10-12 and 18, Dordi teaches a method of positioning a substrate in a processing chamber. A full coverage barrier layer is deposited on a substrate, next a seed layer (patching layer) is electrochemically deposited on a substrate by the use of an electrochemical bath and a plating bias. During this process the substrate is immersed into the

electroplating bath. Next the substrate is transferred into an electrochemical deposition cell (in situ) to form a metal layer and the interconnect features (e.g. vias, trenches, etc.) are filled with copper (Figure 3; Col. 3, Ln. 13-21; Col. 4, Ln. 64-Col. 5, Ln. 35; Col. 7, Ln. 3-54; and Col. 9, Ln. 15-47). All three the layers are conductive since they are made of copper (Col. 7, Ln. 15-21). The current density used in the plating process is between 10 to 80 mA*sec/cm² (Col. 9, Ln. 32-37).

With regard to Claims 2-4, 9, 13-15, the bias is applied to the substrate for a time period of 1 to 20 seconds and the resulting wattage is between 1000 W and 5000 W. The current is between 10 to 80 amperes. Since the voltage used is calculated by the watts divided by the current, the voltage is in the range of 12 volts to 500 volts (Col. 7, Ln. 22-55; Col. 9, Ln. 15-47 and Col. 11, Ln. 21-60).

With regard to Claims 19-21, Dordi teaches selecting the current density based upon the desired deposition rate (Col. 9, Ln. 28-37).

Double Patenting

7. A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process ... may obtain a patent therefor ..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957); and *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the conflicting claims so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

8. Claims 11-12 and 16-17 are provisionally rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 59, 67, 93 and 97 of copending Application No. 09/614407.

This is a provisional double patenting rejection since the conflicting claims have not in fact been patented.

9. Claim 13 is provisionally rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 69-71 of copending Application No. 09/614407. This is a provisional double patenting rejection since the conflicting claims have not in fact been patented.

10. Claim 14 is provisionally rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 72-73 and 76-77 of copending Application No. 09/614407. This is a provisional double patenting rejection since the conflicting claims have not in fact been patented.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Vivek Koppikar** whose telephone number is (703) 305-6618. The examiner can normally be reached on Monday-Friday from 8 AM to 5 PM, Eastern Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Deborah Jones, can be reached at (703) 308-3822. The fax phone numbers for the organization where this application or proceeding are assigned are (703) 305-7718 for regular communications and (703) 305-3599 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Vivek Koppikar
Vivek Koppikar

9/30/03

Deborah Jones
DEBORAH JONES
SUPERVISORY PATENT EXAMINER